EE211
PRINCIPLES OF MICROECONOMICS

Topic 6:

The Theory of Consumer Choice

Topics

- Utility Theory (Cardinal Approach)
  - Utility
  - Marginal utility
  - Law of diminishing marginal utility
- Indifference Curve Theory (Ordinal Approach)
  - Indifference curve
  - Marginal rate of substitution
  - Budget line
  - Consumer equilibrium
- Demand curve derivation
- Applications

Rank

Part I: Utility Theory (Cardinal Approach)

- **Utility** is the *satisfaction* or *well-being* that a consumer receives from consuming some good or service.
  - Economists assume that, in making their choices, consumers are motivated to maximize their utility.

- **Total utility** is the total satisfaction resulting from consumption of a given commodity by a consumer.

- **Marginal utility** is the *additional satisfaction* obtained by a consumer from consuming one *additional unit* of a commodity.
  - $MU_x = \frac{\Delta U}{\Delta X} \approx \frac{du}{dx}$

(MU)

(derivative of u w.r.t. x)

Example: Utility Schedules

MU's are +ve.

Given

Number of Coffee Tom Drinks per day	Tom's Total Utility (TU)	Tom's Marginal Utility (MU)
0	0	$\Delta U = 30$
1 ($\Delta X = 1$)	30	$\Delta U = 20$
2 ($\Delta X = 1$)	50	$\Delta U = 15$
3	65	$\Delta U = 10$
4	75	$\Delta U = 8$
5	83	$\Delta U = 6$
6	89	

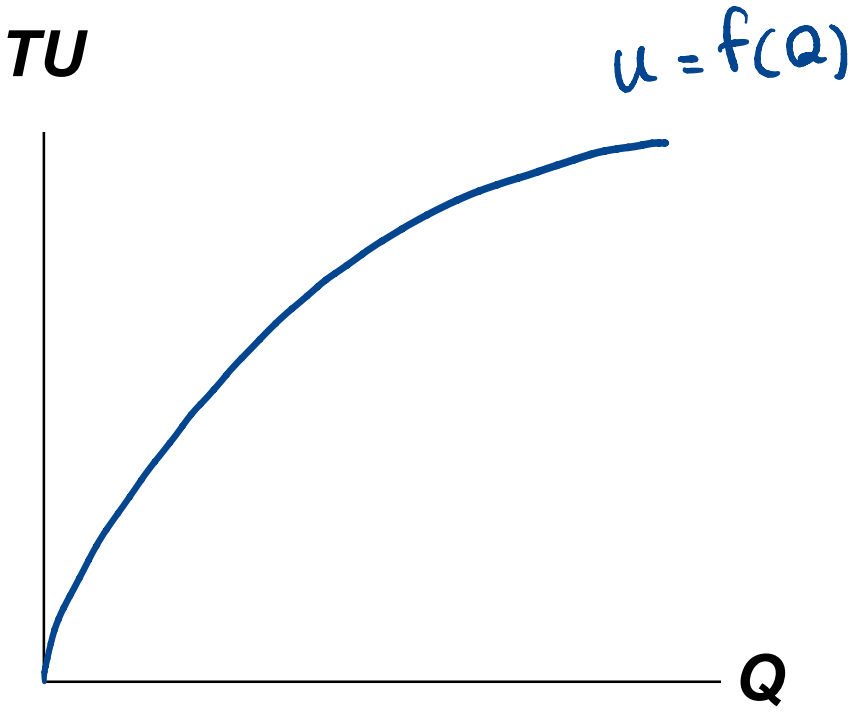
Big → small

Q: Can MU of any good be negative?

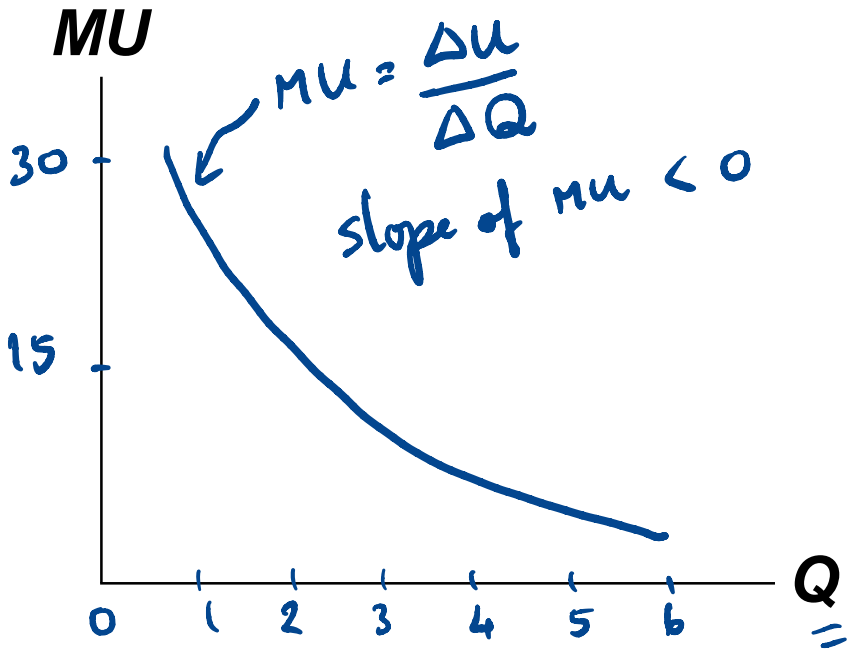
→ Yes.

Example: Utility Graphs

- Total Utility



- Marginal Utility



Total utility rises, but marginal utility decreases, as consumption rises.

Diminishing Marginal Utility

- ***Law of diminishing marginal utility***

"The utility that any consumer derives from *successive* units of a particular product consumed over some period of time *diminishes* as total consumption of the product increases, if the consumption of all other products is unchanged."

Maximizing Utility

Given P_X and P_Y

- The consumer's decision: (in Case there are 2 consumption goods : X and Y)

A optimal utility-maximizing consumer allocates expenditures so that the utility obtained from the last dollars spent on each product is equal.

Consumer's utility maximization :

$$\max_{X,Y} U(X,Y)$$

subject to $P_X \cdot X + P_Y \cdot Y = I$ (income)

Mathematically,

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

Alternatively,

$$\frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

$\rightarrow (X^*, Y^*)$ optimal bundle of X & Y.

Example: Utility Maximization

- Suppose you are buying Good X for $1 each and Good Y for $3 each, and the marginal utility of each good is the following.

# of X	MU_x	MU_x/P_x
1	30	30
2	21	21
3	15	15

# of Y	MU_y	MU_y/P_y
1	60	20
2	51	17
3	45	15

$\Rightarrow (X^*, Y^*) = (3,3)$

How many units of goods X and Y should you buy in order to maximize your utility?

What if $\frac{MU_x}{P_x} > \frac{MU_Y}{P_Y}$? ($\uparrow x$, $\downarrow Y$) ← not in eqm

Should you consume more of x or more of Y?

Goal:

$$\frac{MU_x}{P_x} = \frac{MU_Y}{P_Y}$$

If $\frac{MU_x}{P_x}$ is higher,

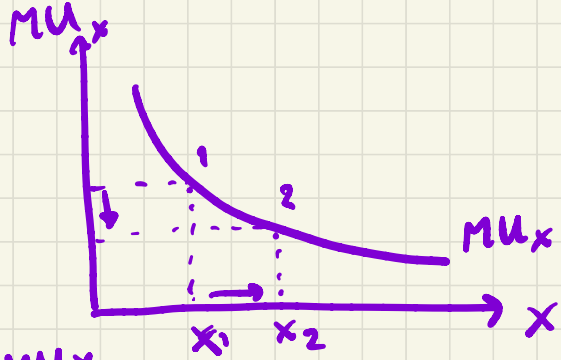
⇒ want to consume more of x

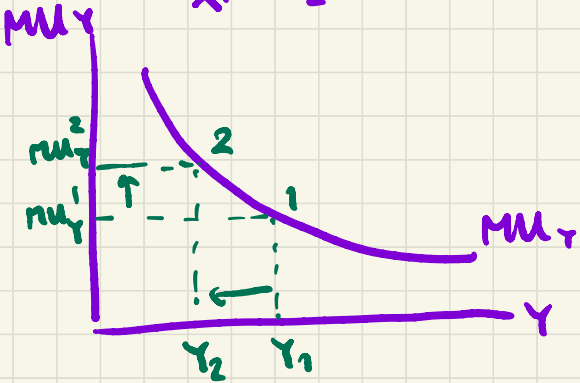
⇒ $MU_x \downarrow$

If $\frac{MU_Y}{P_Y}$ is lower,

⇒ want to consume less of Y

⇒ $MU_Y \uparrow$





$$\frac{MU_x}{P_x} = \frac{MU_Y}{P_Y}$$ ← eqm ✓✓

Part II. Indifference Curve Theory (Ordinal Approach)

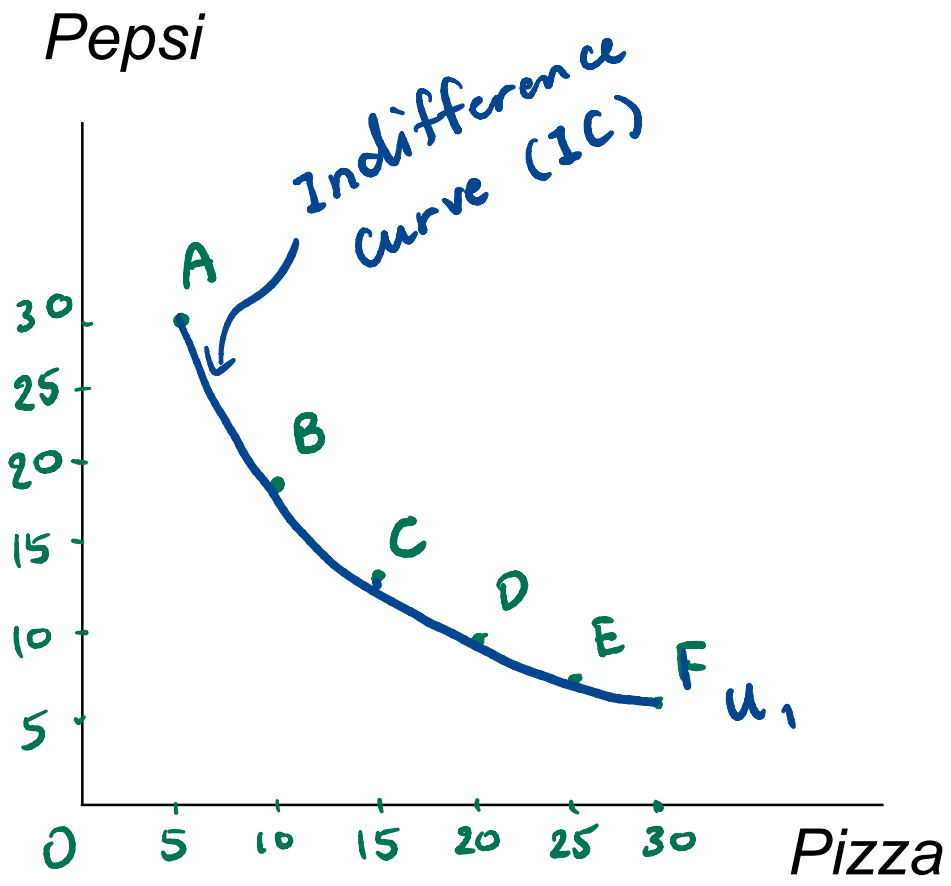
- There is **no** numerical value attached to consumer's utility.
- Instead, consumer is asked which bundle is preferred to which.
- **Indifference curve** shows consumption bundles that give the consumer the same level of satisfaction.
- With 2 products X and Y, a bundle is represented by a point in diagram.

Example: Indifference Curve

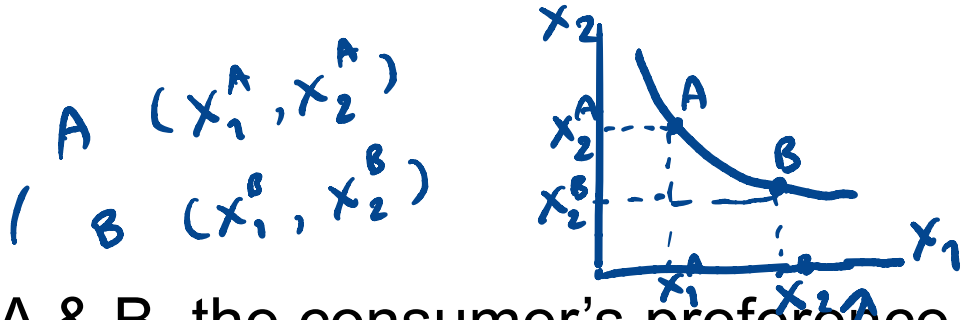
units

Bundle	Pepsi	Pizza
A	30	5
B	18	10
C	13	15
D	10	20
E	8	25
F	7	30

same utility level : U_1



Assumptions



- Given any 2 bundles A & B, the consumer's preference is assumed to be exactly one of the followings:

✓ 1. A is preferred to B ($A \succ B$). , OR

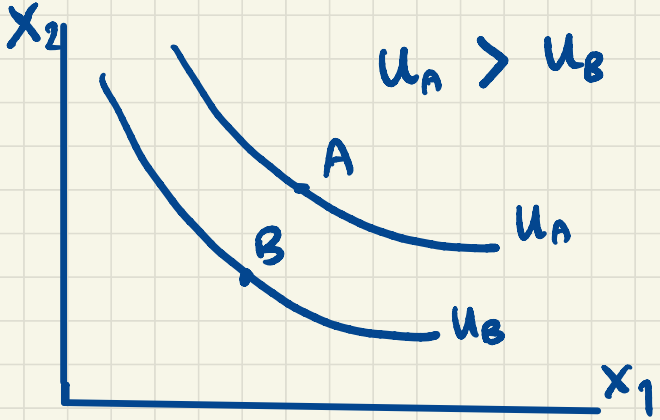
✓ 2. B is preferred to A ($A \prec B$). , OR

✓ 3. A & B are indifferent ($A \sim B$).

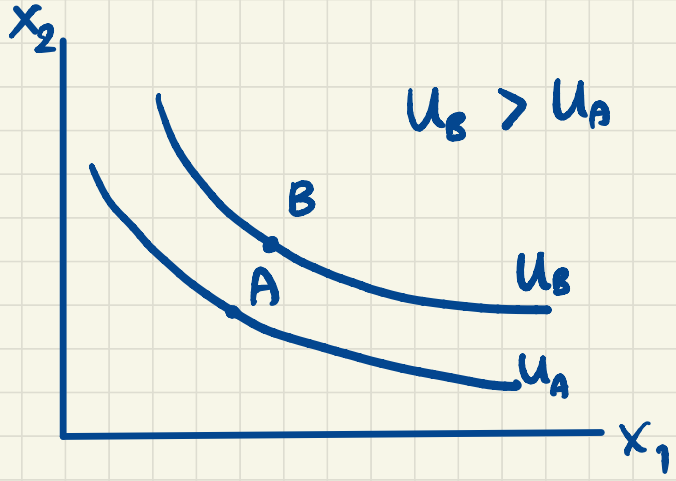
- Consumer is assumed to be rational.
  - More is preferred to less.
  - If $A \succ B$ and $B \succ C$, then $A \succ C$.

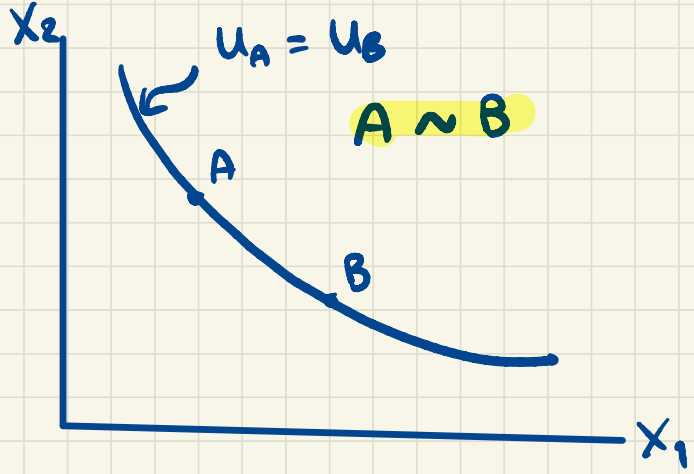
preferred to

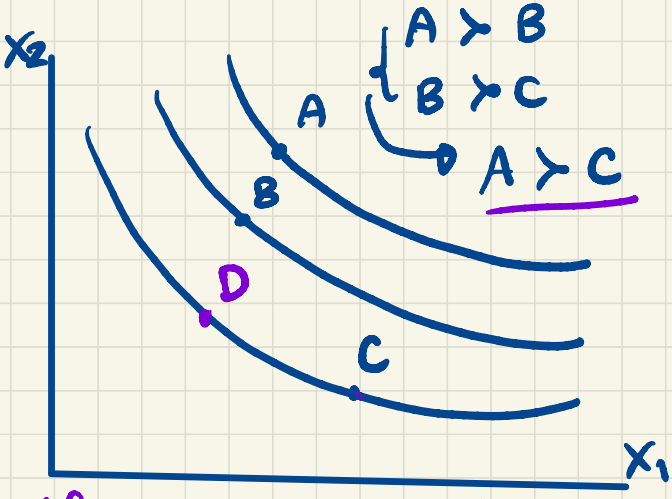
$A \succ B$



$B \succ A$







If $C \sim D$, $A \succ C$

Marginal Rate of Substitution

- **Marginal rate of substitution (MRS)** is the rate at which a consumer is willing to trade one good for another.
- Also, it is the slope of the indifference curve.

$$MRS = -\frac{MU_X}{MU_Y} = \frac{\Delta Y}{\Delta X}$$

- Basic assumptions of indifference curve theory:

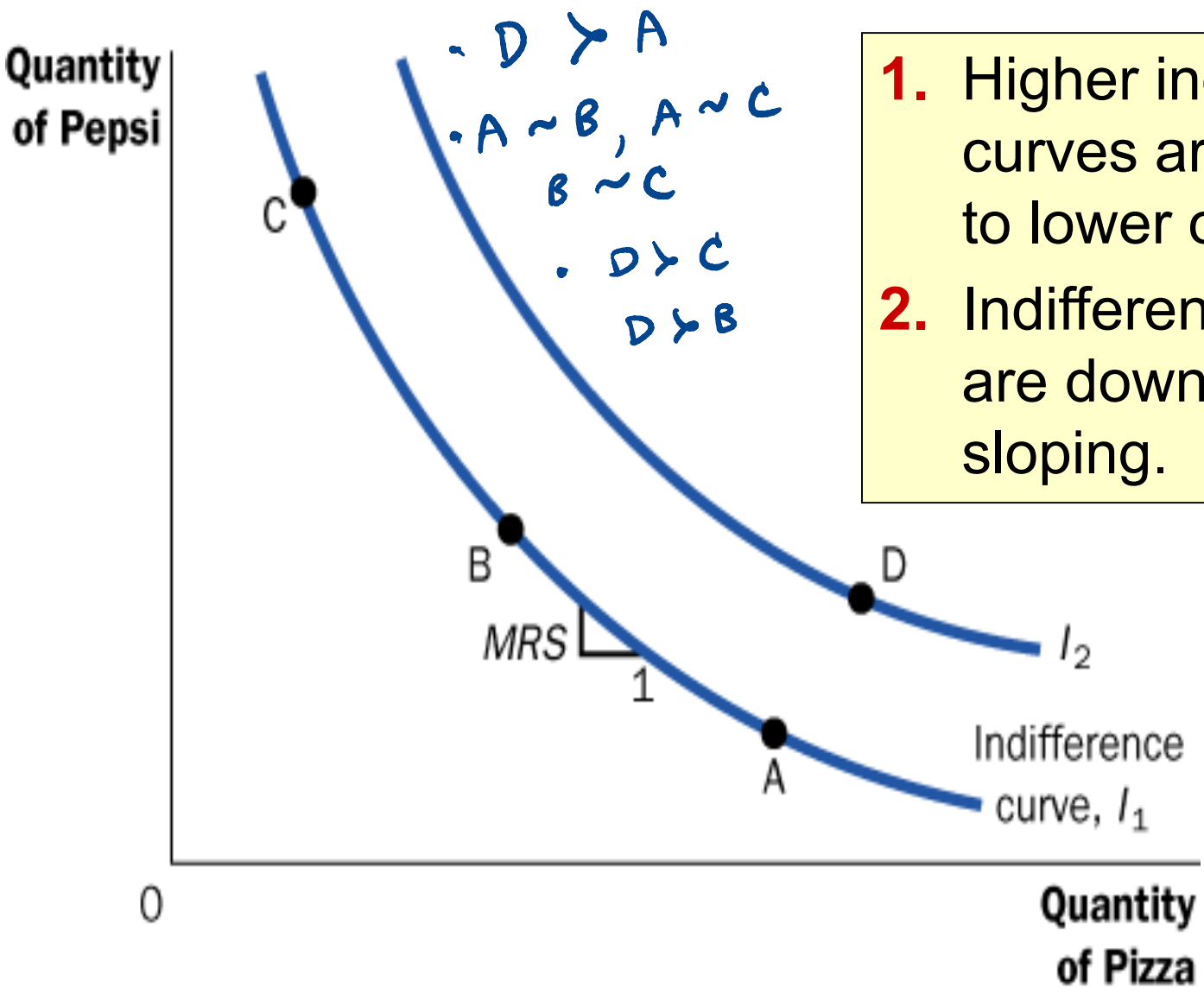
1. The algebraic value of the MRS between two goods is always negative.
2. The MRS is diminishing (i.e. any indifference curve becomes flatter as the consumer moves downward and to the right along the curve).

Example: Indifference Curve& MRS

Bundle	Pepsi (Y)	Pizza (X)
A	30	5
B	18	10
C	13	15
D	10	20
E	8	25
F	7	30

Change	Change in Pepsi (ΔY)	Change in Pizza (ΔX)	MRS $= \frac{\Delta Y}{\Delta X}$
A→B	-12	5	-2.4
B→C	-5	5	-1
C→D	-3	5	-0.6
D→E	-2	5	-0.4
E→F	-1	5	-0.2

Properties of Indifference Curve



- D ≻ A
- A ~ B, A ~ C
  B ~ C
- D ≻ C
  D ≻ B

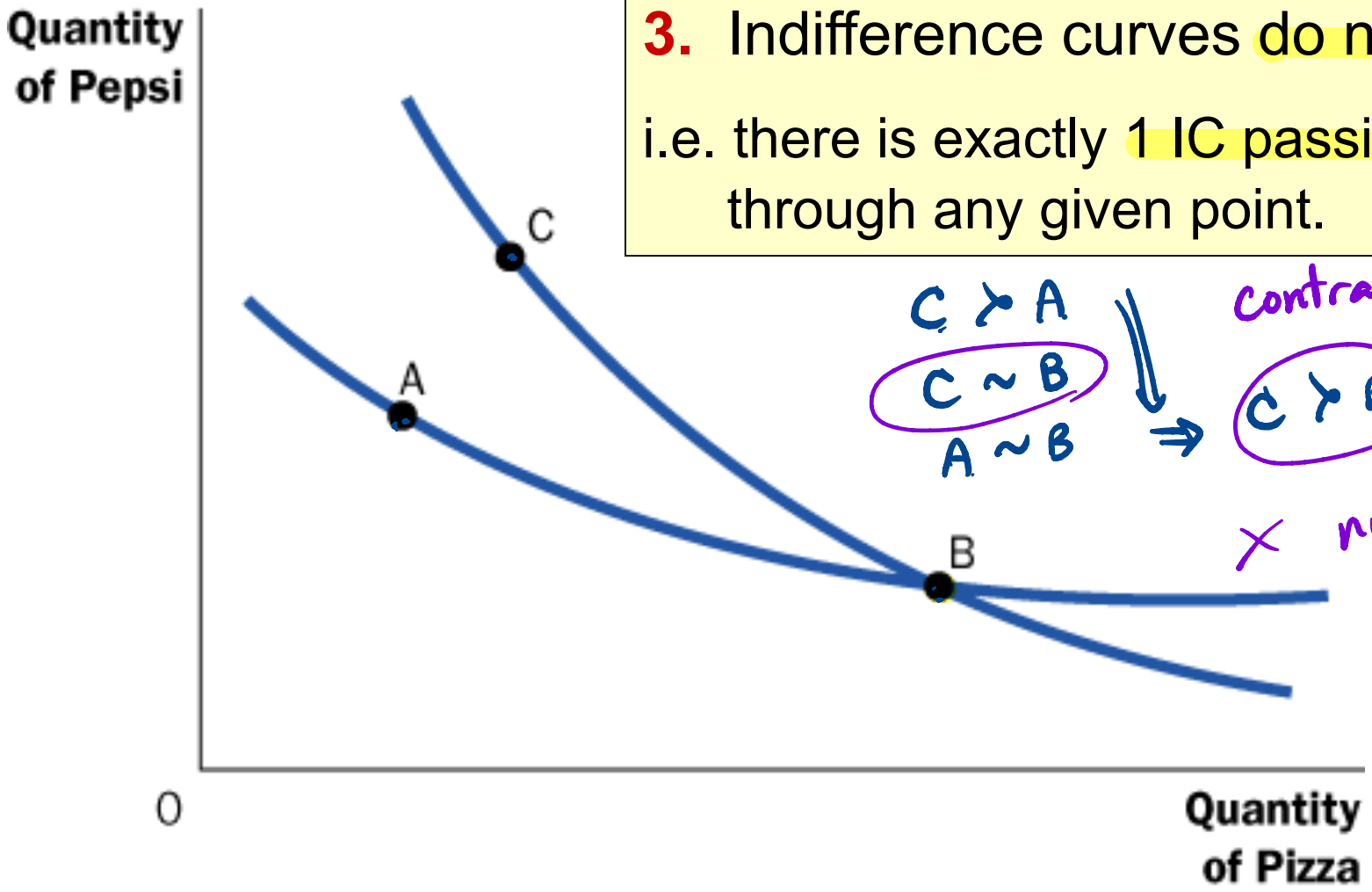
1. Higher indifference curves are preferred to lower ones.
2. Indifference curves are downward sloping.

MRS < 0

Properties of Indifference Curve

3. Indifference curves do not cross.

i.e. there is exactly 1 IC passing through any given point.



$C \succ A$

$C \sim B$

$A \sim B$

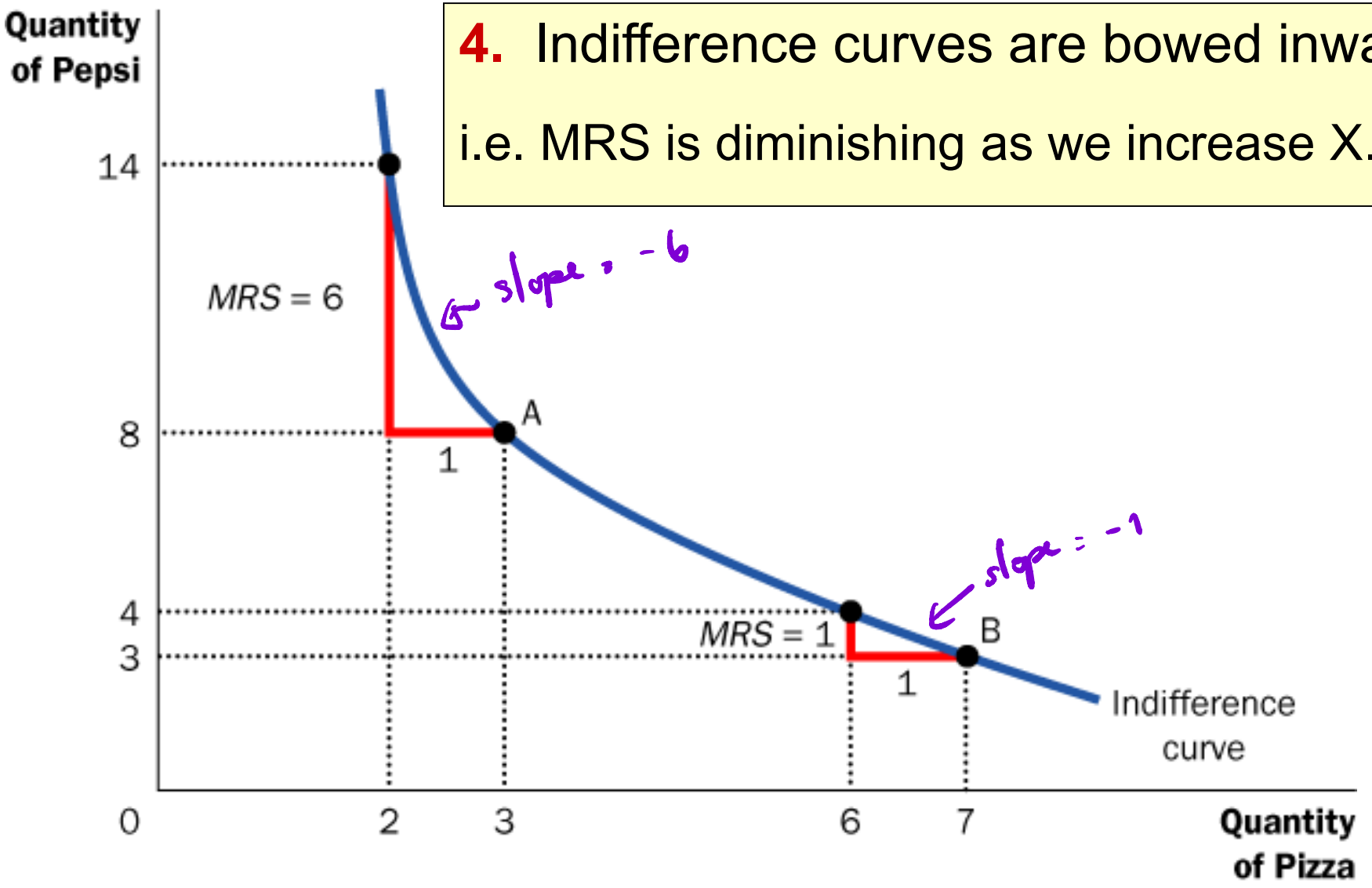
$\Rightarrow C \succ B$ contradiction!

$\times$ not possible.

Properties of Indifference Curve

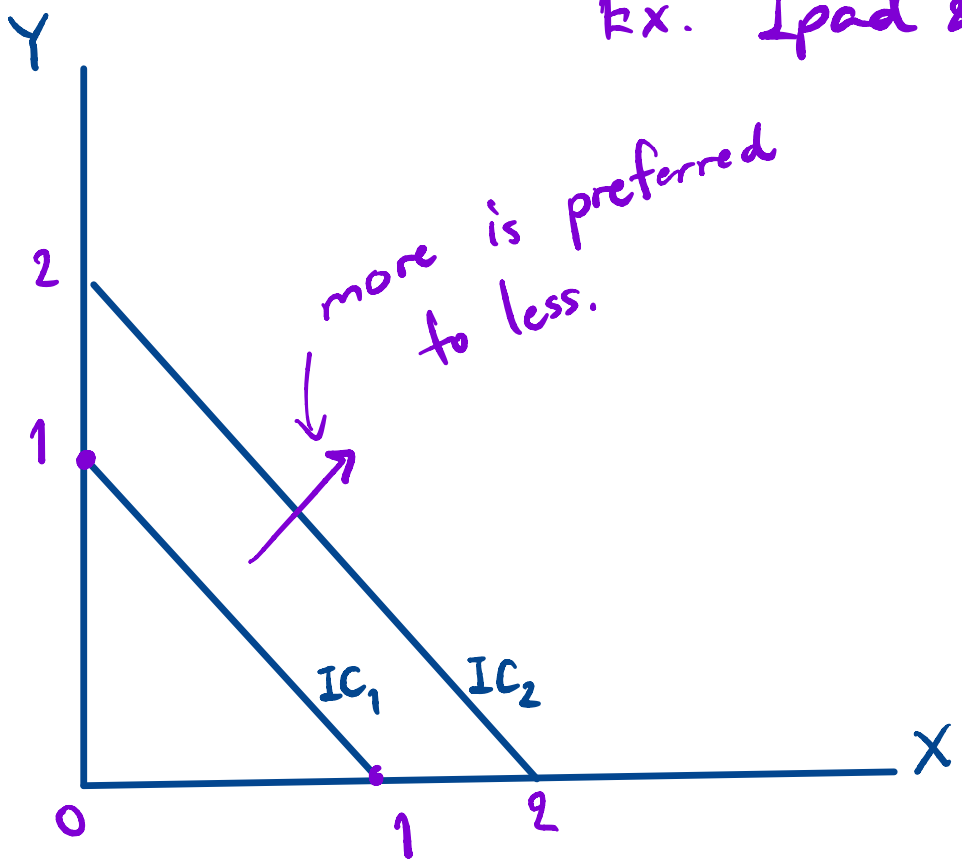
4. Indifference curves are bowed inward.

i.e. MRS is diminishing as we increase X.

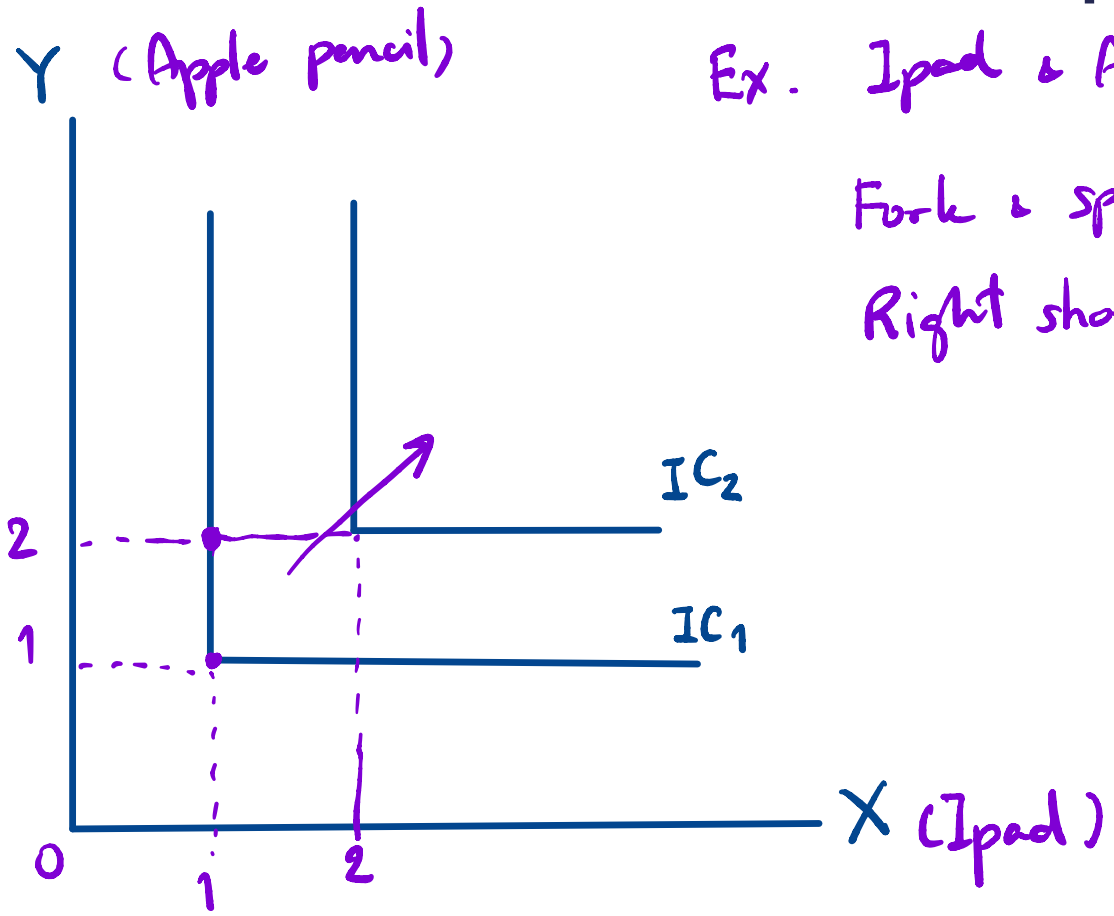


Extreme Case: Perfect Substitutes

Ex. Ipad & Galaxy Note



Extreme Case: Perfect Complements



Ex. Ipad & Apple pencil.

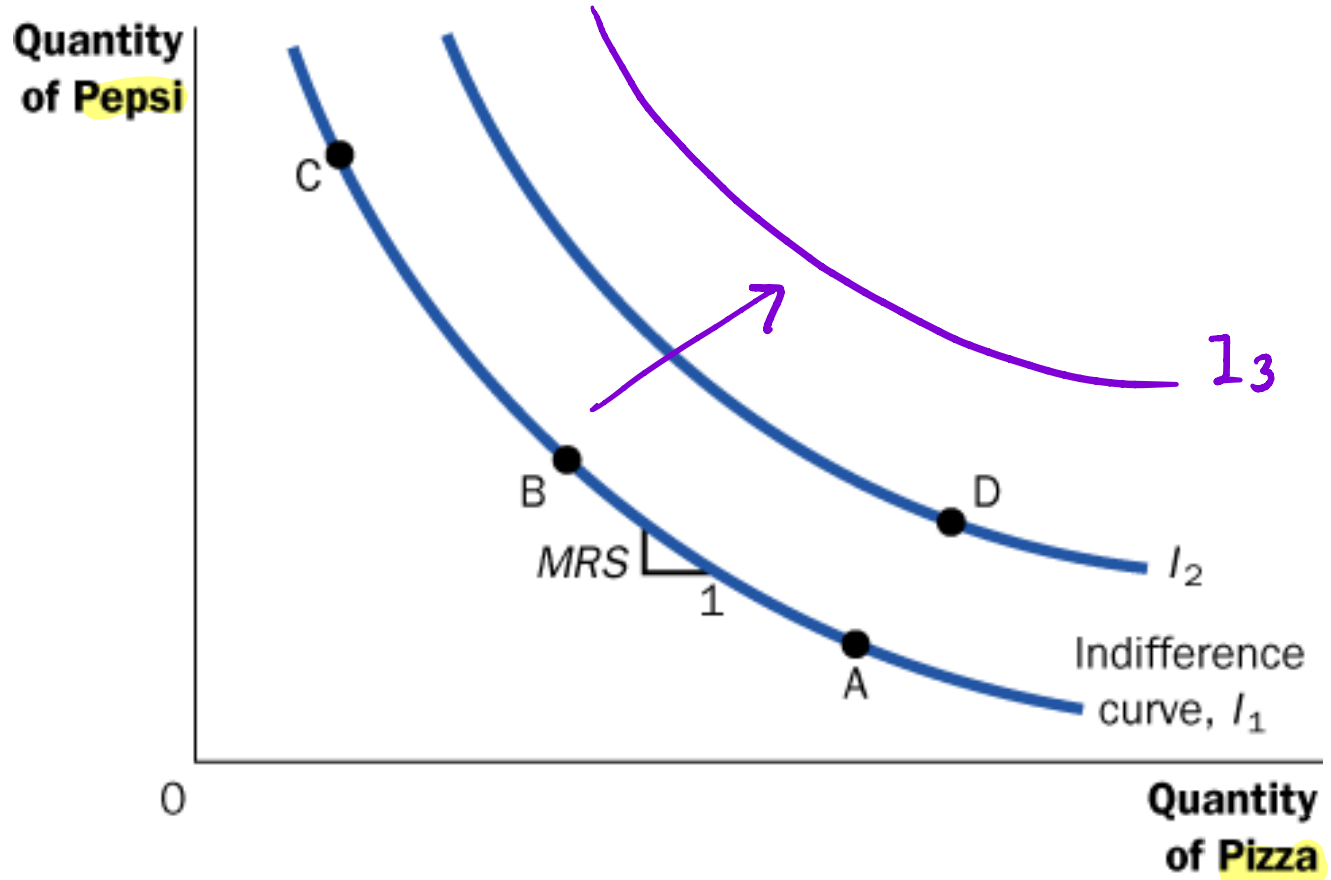
Fork & spoon.

Right shoe & Left shoe.

Part III. Consumer's Equilibrium

① IC ,
② Budget constraint ,

- Recall: **Indifference curve** shows consumption bundles that give the consumer the same level of satisfaction.



Extra Notes on Indifference Curve (1)

- MRS is the slope of the indifference curve, and MRS is diminishing (in absolute value) as X increases.
- At any point on indifference curve, the slope is $\frac{\Delta Y}{\Delta X}$.
- As the consumer consumes more X and reduces consumption of Y, her utility changes by:

$$\Delta X > 0 \rightarrow \Delta U_x \approx MU_x \times \Delta X$$

$$\Delta Y < 0 \rightarrow \Delta U_y \approx MU_y \times \Delta Y$$

$U(X, Y)$

$\Delta U = \Delta U_x + \Delta U_Y$

- But on the an indifference curve, the utility is the same:

$$\Delta U = \rightarrow \Delta U_x + \Delta U_y = 0$$

Extra Notes on Indifference Curve (2)

- So,

$\Delta U = \Delta U_x + \Delta U_y = 0 \iff MU_x \cdot \Delta X + MU_y \cdot \Delta Y = 0$

$$\Delta U_x = -\Delta U_y$$

$$\mathrm{MU_x}\Delta X \approx -\mathrm{MU_y}\Delta Y$$

(Discrete change)

$$\rightarrow \quad \frac{\Delta Y}{\Delta X} \approx -\frac{MU_x}{MU_y}$$

$$\rightarrow \quad \frac{dY}{dX} = -\frac{MU_x}{MU_y} : \mathrm{MRS} = \text{slope of Ic.}$$

Continuous change

Budget Constraint

- **Budget constraint (or budget line)**: the limit on the consumption bundles that a consumer can afford.
  - It shows all combinations (bundles) of the two goods that the consumer can afford to buy.
- Consider the case of 2 goods: Pizza (X) and Pepsi (Y). Suppose P_x = \$10, P_y = \$2, and budget (B) = \$1000. (Given)
- The budget line can be written as:

$$P_x X + P_y Y = B$$

Assume consumer spends all the budget.

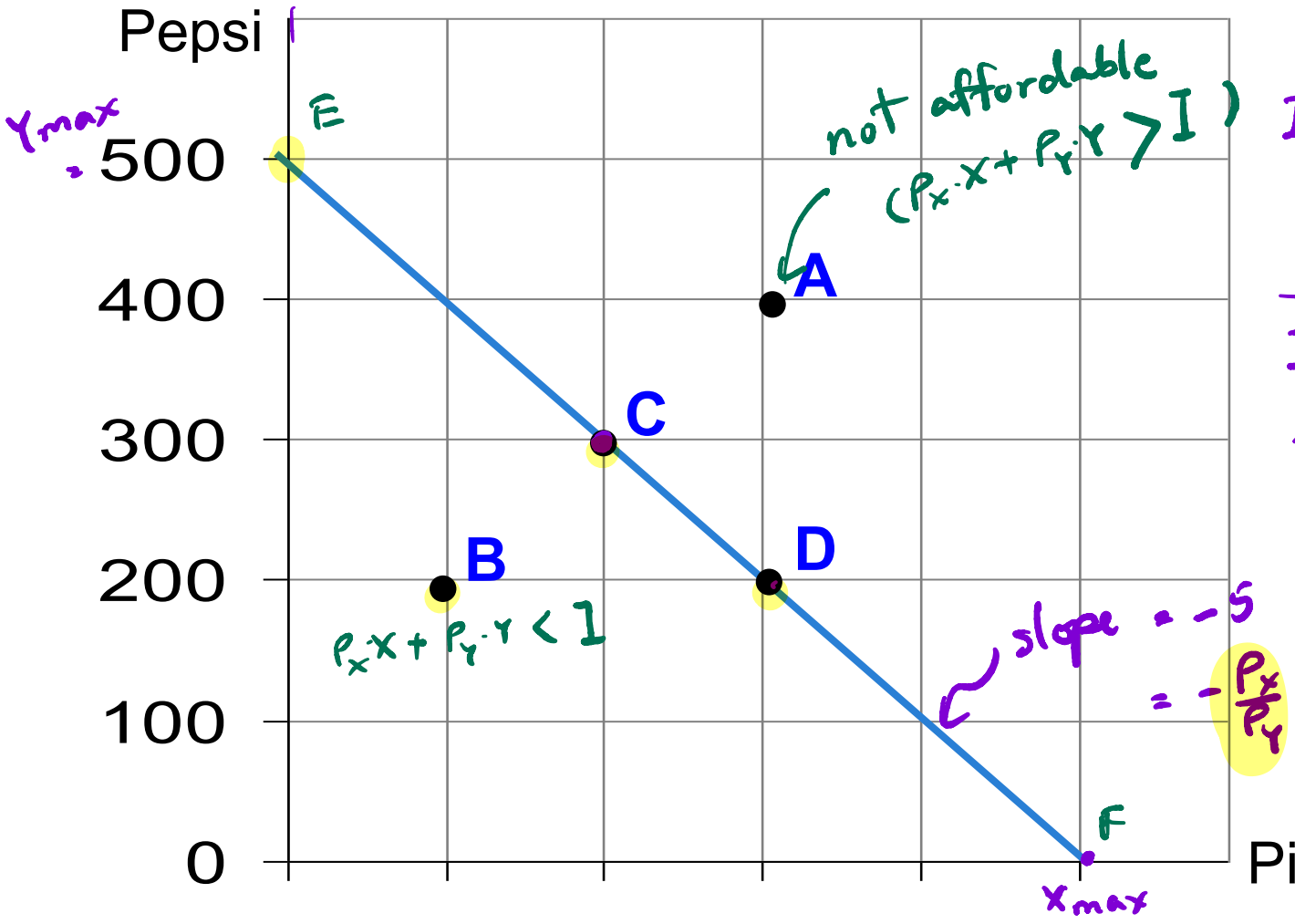
total expenditures ↑ total income (no savings, no borrowing)

Graph: Budget Constraint

$P_X \cdot X + P_Y \cdot Y = 1000$

If $X = 0$, $Y_{max} = \frac{1000}{2} = 500$

If $Y = 0$, $X_{max} = \frac{1000}{10} = 100$



If $X = 40$, $P_X \cdot X = 400$

$\Rightarrow P_Y \cdot Y = 600$

$Y = 300$

$P_X \cdot X + P_Y \cdot Y = B$

$P_Y \cdot Y = B - P_X \cdot X$

$Y = \frac{B}{P_Y} - \frac{P_X}{P_Y} \cdot X$

Slope of the Budget Constraint

- The slope of the budget constraint equals:
  - the rate at which the consumer can trade Pepsi for pizza (Given or determined by the market).
  - the opportunity cost of pizza in terms of Pepsi
  - the relative price of pizza.

That is:

$$Slope\ of\ Budget\ line = -\frac{P_x}{P_y}$$

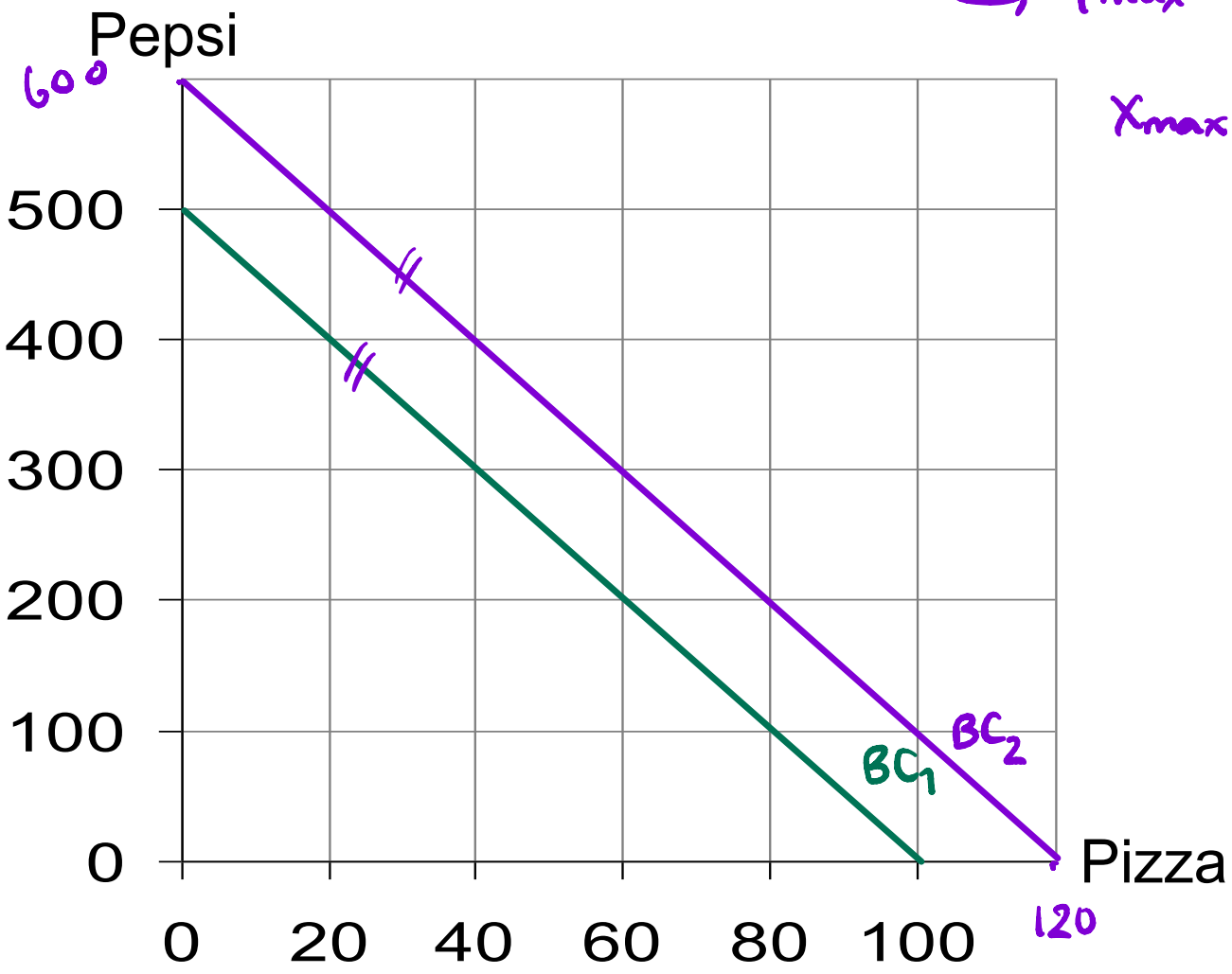
Change in Budget Constraint: Higher Income (1)

- Suppose budget increases to $1200. I_2

$I_1 = 1000$

$Y_{max} = \frac{1200}{2} = 600$

$X_{max} = \frac{1200}{10} = 120$



Consumer's Problem: Optimization

$\max_{x,y} U(x,y)$ subject to $P_x \cdot x + P_y \cdot y = \text{Income} \Rightarrow x^*, y^*$

- Consumer's problem is to maximize his/her utility (i.e. satisfaction) under the budget constraint.
- The **optimal bundle** is at the point where the budget constraint touches the highest indifference curve.
  - i.e., the indifference curve and budget constraint have the same slope.

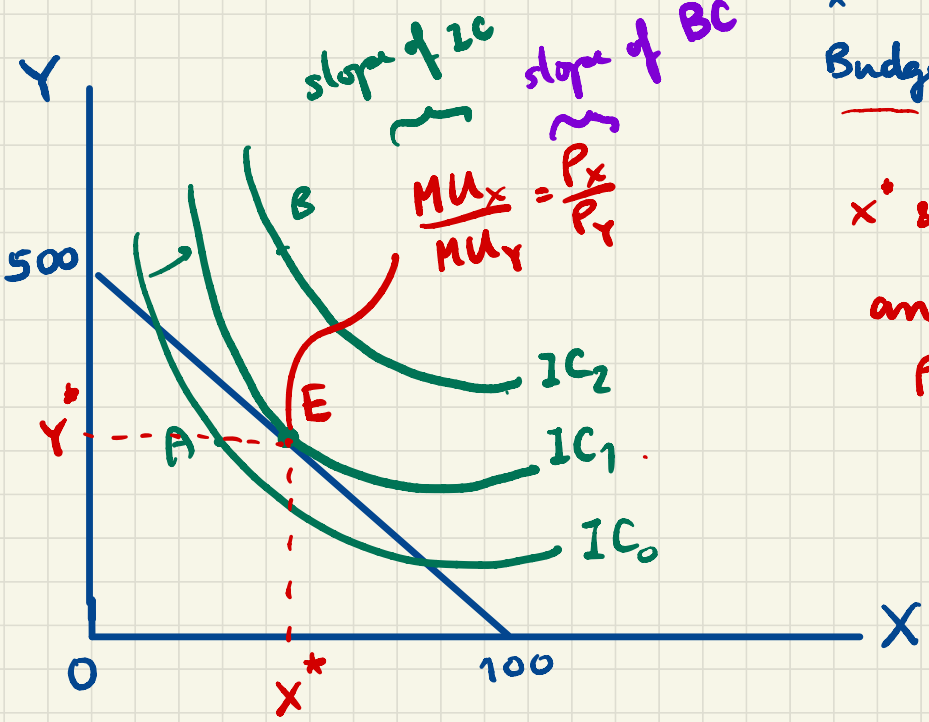
$= -\frac{MU_x}{MU_y}$ $\quad -\frac{P_x}{P_y}$

- Since the slope of IC is the MRS and the slope of the budget constraint is the relative price, the optimal bundle is where:

$$\frac{P_x}{P_y} = \frac{MU_x}{MU_y} \iff \frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

★★★

Utility Maximization



$P_X = \$10$, $P_Y = \$2$

Budget $= \$1{,}000$

x^* & Y^* maximize (U)

and

$P_X \cdot X^* + P_Y \cdot Y^* = 1000$

Midterm